Guidelines for Wood Additions to First and Second Order Streams

Introduction

Above: a section of stream which lacks woody material and as a result the stream lacks pools, riffles, and cascades.

A lack of woody biomass in Northeast streams is due primarily to the lack of old trees in riparian areas which die and fall into streams naturally. Slash laws prohibit loggers from leaving woody biomass in streams or on floodplains within 50 feet of perennial streams. Additionally, culverts and other infrastructure collect wood and are cleaned-out seasonally further reducing the amount of wood in streams and on floodplains. Woody biomass in streams creates several key ecological feedbacks, which are important for the larger watershed. This guide presents an overview of the environmental benefits from adding woody biomass to first and second order streams, baselines for evaluating stream condition, site selection, permitting, risk assessment, and tips for successful installation.

Environmental Benefits

Water Quality

During high flow events sediments (sand, gravel, silts) and organic matter (twigs, logs, and leaves) are mobilized and moved out of first and second order streams. Without woody material to reduce velocities and retain inorganic and organic materials in these stream segments, they are deposited into larger water bodies and wetland systems much lower in the watershed. This deposition known as siltation changes the depth of water bodies, buries sub-aquatic vegetation, and increases nutrient loading. Upstream the converse happens, stream channels become incised from the constant loss of material and streams lose contact with their floodplains which results in increased velocities which result in damage to downstream infrastructure and the system itself. The lack of retention of wood, organic material, and sediment translates to a reduction in biomass of insects, invertebrates, and fish.

Fish Habitat

Wood in streams increases fish populations by providing deeper pools and a greater diversity of habitats which help fish persist during hot summer months and long winters. Cascades and riffles are formed from the stream flowing over logs which increases oxygen content. Wood also provides escape cover, increases gravel bars for spawning, and collects organic matter which increases populations of insects

Gravels accumulate behind wood in a stream. Note the complexity of the stream bed.

and invertebrates. During drought conditions, first order streams become fragmented and fish are forced to wait for the cooler fall rains often in a single pool. Increasing the number of pools in a stream segment greatly increases low-flow holding areas as well as allowing fish to overwinter and survive drought conditions. In the Green Mountains over a 10 year period, adding 4 pieces of wood, which were in contact with the water year round, every 100 feet of stream showed increases in trout populations from 2 to 5 times (40 lbs/acre up to 200 lbs/acre!)

Reduced Flood Intensities

Incised streams are created when scour in the stream bed deepens the channel and as a result the stream loses contact with the floodplain. Log-jams in these streams are valuable as they collect sediment on the upstream side and reduce flow velocities. As sediments accrete behind log-jams, there is reduced hydrologic capacity at that location allowing flood waters and sediment during high flows to access the floodplain. Intact forested floodplains offer flood water storage and reduce peak discharges whereby further collecting sediments and organic matter.

Best Management Practices of Adding Woody Material to Streams

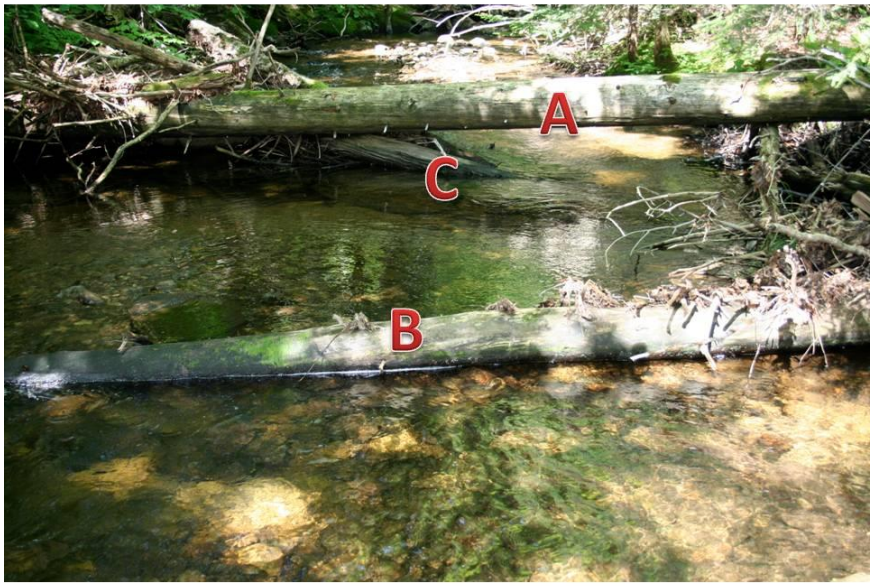
Because adding wood to streams can have unexpected effects to stream geomorphology, such as increased bank erosion, damage to culverts, change of flood regimes and – deposition of cut wood onto neighboring properties, great care must be taken in selecting proper sites. The list below identifies some key steps to consider in preparation of adding woody material to streams.

- ✓ Obtain Minimum Impact Expedited Wetlands Permit
- ✓ At least 1000 feet of stream for treatment
- ✓ NH requires standard dredge and fill permits for wood additions to streams
- ✓ Landowners who own both sides of the stream (Streams which are not property boundaries)
- ✓ First and Second Order streams which are typically less than 15 feet wide
- ✓ Rural landscapes which lack downstream infrastructure (culverts, roads, houses, etc…)
- ✓ Bedrock controlled stream channels, especially with narrows which will create log-jams
- ✓ Low-Gradient Stream Segments
- ✓ Downstream Beaver Flowages or wetlands which will collect wood moving downstream
- ✓ Where ample canopy cover exists and cutting trees to add to the stream will not greatly reduce shading.

- ✓ If cutting trees will reduce stream shading, cut trees further from the stream and haul them over in segments.
- ✓ Don't cut trees on the stream bank, they will eventually fall in on their own and offer erosion protection. Also, undercut banks are a favorite for trout and other fish.
- ✓ Leave felled logs on floodplains to increase roughness, reduce flood intensities, improve timber quality and wildlife habitat.
- ✓ Develop areas called "strainers" where a few large trees can be felled across the stream on the downstream end of the treatment to collect any wood which may dislodge during high flows.
- ✓ When creating a strainer, the best situation is where these trees become "wedged" between other healthy trees and large immovable boulders etc. These can also be cabled to other live trees for support.
- ✓ Consider creating strainers on bends in the stream, and in areas where wood is already accumulating.
- ✓ Cut trees a few feet from the ground leaving a higher than normal stump on the downstream side to help secure recently cut trees.

Measuring Existing Wood – How Much Wood to Add

For each 100 foot section of stream, count the pieces of wood 4 inches or greater in diameter which are in contact with the water year-round (during low flows). A target benchmark is 4 pieces of wood in-contact with the water at low flows for every 100 feet of stream. Streams with lower amounts then this benchmark are typically good candidates and will benefit greatly from additions. In old growth forests, there is usually so much wood it is hard to see the stream! Keep this in mind when selecting a desired outcome.



Above: **A)** shows a piece of wood which does not count in the survey as it is not in contact with the water. **B)** and **C)** shows pieces of wood larger than 4 inches in diameter in contact with the water and counts as part of the survey. For survey purposes, the above picture would have 2 pieces of wood in this stretch.

The above picture shows created habitat for fish from wood additions. For each 100 foot section note pools, cascades, riffles and glides. Try to establish 2 to 3 of each per 100 feet of stream.

On floodplains, note the amount of downed wood and the overall roughness of the floodplain. Several logs can be left on the forest floor as part of timber stand improvement and will reduce flood velocities and collect sediment.

Above: a desirable area at the downstream end of the treatment area to collect any dislodged wood. Downstream, neighbors can become very upset and even file a law suit if cut wood ends up on their property.

Above left: cutting a tree higher than normal to help secure the tree at high flows.

Above right: a felled tree “wedged” between other trees to help secure it during high flows.

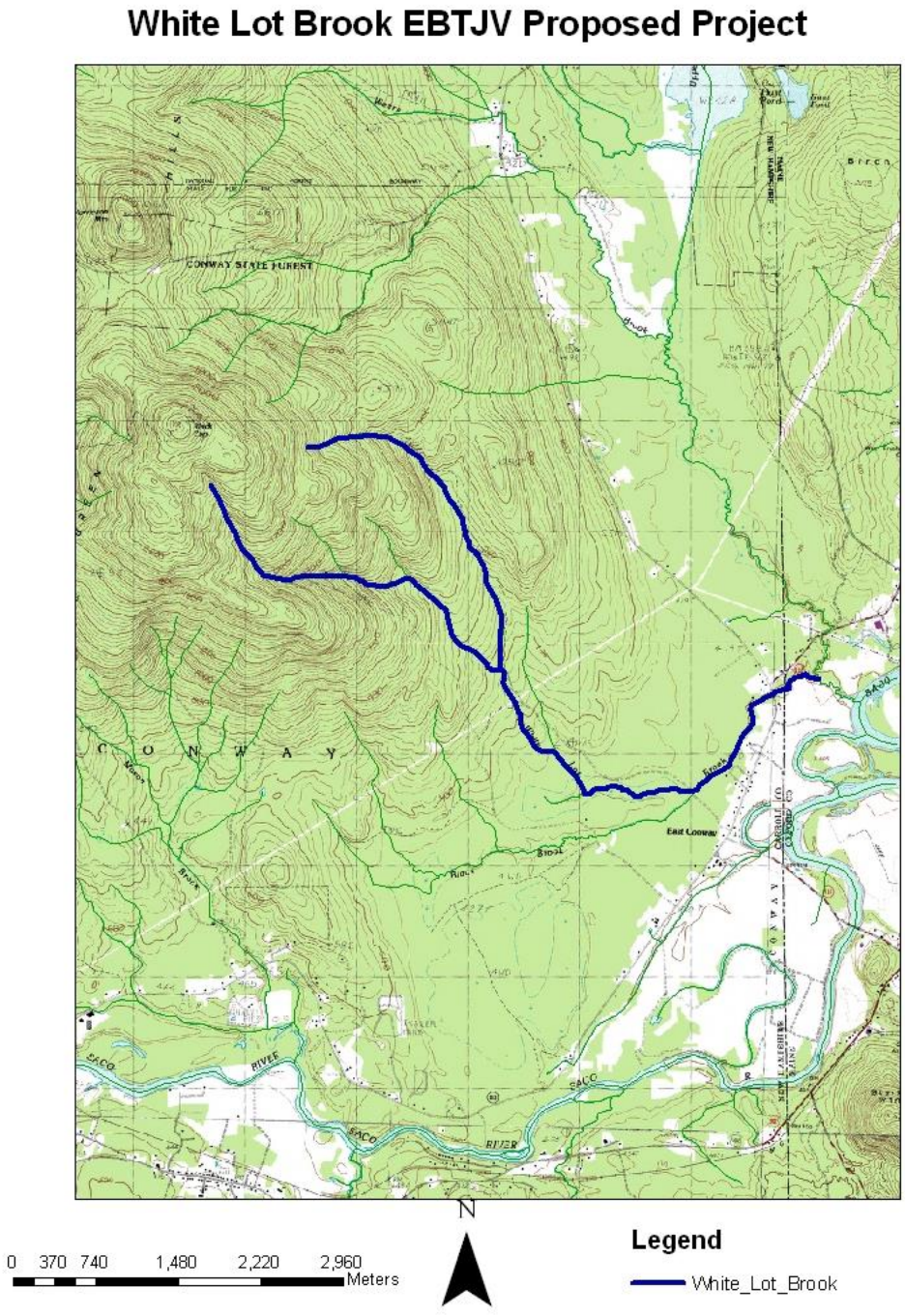
Above left: segments of cut trees added to the stream. This technique is useful to try to get wood buried into the stream bed, and also if cutting trees adjacent to the stream are not needed.

Above right : an example of wood which is buried in the stream bed, and in contact with the water at low flows. Note the cascade and pool it creates.

Above left: several leaning trees on the stream bank which should not be cut as they are essential to stream shading and help secure the stream bank. They will fall in on their own eventually.

Above right: trees associated with an undercut bank which is great habitat, these trees should not be cut as they help secure the bank.

Both photos: Note the difference in grain sizes in both streams; the left picture outlines a coarse grained substrate typical of upland NH streams. The stream on the right is on the coastal plain which is silty in texture and higher pH.



Above: A typical NH stream where wood has been added. When planning an installation, note the soils, hydrologic groups and slope of the watershed. In this case, upper portions of the stream are bedrock controlled and are steep but the overall watershed size is small which helps reduce risk. The flat area of the lower stream section helps to reduce flood intensities with larger floodplains, lower stream gradients and the installation of a strainer.